GEOTECHNICAL ENGINEERING REPORT

PREPARED BY:

THE RILEY GROUP, INC.
17522 BOTHELL WAY NORTHEAST
BOTHELL, WASHINGTON 98011

PREPARED FOR:

STEPHEN KERN
3702 ENSIGN ROAD NORTHEAST
OLYMPIA, WASHINGTON 98506

RGI PROJECT NO. 2019-032

PROPOSED STARBUCKS COFFEE
SOUTHEAST CORNER OF STATION DRIVE AND DUPONT-STEILACOOM HIGHWAY
DUPONT, WASHINGTON

MARCH 25, 2019

Corporate Office
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone 425.415.0551 ♦ Fax 425.415.0311

www.riley-group.com

RILEYGROUP

March 25, 2019

Stephen Kern
3702 Ensign Road Northeast
Olympia, Washington 98506

Subject: **Geotechnical Engineering Report**
Proposed Starbucks Coffee
Southeast Corner of Station Drive and Dupont-Steilacoom Highway
Dupont, Washington
RGI Project No. 2019-032

Dear Mr. Kern:

As requested, The Riley Group, Inc. (RGI) has performed a Geotechnical Engineering Report (GER) for the above-referenced subject site. Our services were completed in accordance with our proposal PRP2019-050 dated February 26, 2019 and authorized by you on the same day. The information in this report is based on our understanding of the proposed construction, and the soil and groundwater conditions encountered in the test pits completed by RGI at the site on March 8, 2019.

RGI recommends that you submit the project plans and specifications to RGI for a general review so that we may confirm that the recommendations in this report are interpreted and implemented properly in the construction documents. RGI also recommends that a representative of our firm be present on site during portions of the project construction to confirm that the soil and groundwater conditions are consistent with those that form the basis for the engineering recommendations in this report.

If you have any questions or require additional information, please contact us.

Sincerely yours,

THE RILEY GROUP, INC.

State of Washington 2698 Licensed Geologist

3/25/2019

ERIC L. WOODS

Eric L. Woods, LG
Project Geologist

RICKY RUNQI WANG STATE OF WASHINGTON 35013 REGISTERED PROFESSIONAL ENGINEER

3/25/2019

Ricky R. Wang, PhD, PE
Principal Engineer

Corporate Office
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone 425.415.0551 ♦ Fax 425.415.0311

www.riley-group.com

TABLE OF CONTENTS

LIST OF APPENDICES

Executive Summary

This Executive Summary should be used in conjunction with the entire Geotechnical Engineering Report (GER) for design and/or construction purposes. It should be recognized that specific details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. Section 7.0 should be read for an understanding of limitations.

RGI's geotechnical scope of work included the advancement of 5 test pits to a maximum depth of 8.5 feet below ground surface (bgs).

Based on the information obtained from our subsurface exploration, the site is suitable for development of the proposed project. The following geotechnical considerations were identified:

Soil Conditions: The soils encountered during field exploration includes up to 6 feet of fill comprised of loose to medium dense silty sandy gravel over native deposits of gravel with varying amounts of sand and silt.

Groundwater: Groundwater was not encountered during our subsurface exploration.

Foundations: Foundations for the proposed building may be supported on conventional spread footings bearing on existing fill or new structural fill.

Slab-on-grade: Slab-on-grade floors and slabs for the proposed building can be supported on existing fill or new structural fill.

Pavements: The following flexible pavement sections are recommended:

- **For heavy truck traffic areas**: 4 inches of asphalt concrete (AC) over 8 inches of crushed rock base (CRB)
- **For general parking areas**: 3 inches of AC over 6 inches of CRB

If concrete pavement is preferred, the following pavement section can be used.

- **For heavy duty concrete pavement areas**: 6 inches of concrete over 4 inches of CRB
- **For standard duty concrete pavement areas**: 5 inches of concrete over 4 inches of CRB

1.0 Introduction

This Geotechnical Engineering Report (GER) presents the results of the geotechnical engineering services provided for the proposed Starbucks Coffee located at the Southeast Corner of Station Drive and Dupont-Steilacoom Highway in Dupont, Washington. The approximate location of the site is shown on Figure 1. The eastern portion of the site is being used as a gravel parking lot, and the western portion of the site is an undeveloped grass slope.

The recommendations in the following sections of this GER are based upon our current understanding of the proposed site development as outlined below. If actual features vary or changes are made, we should review them in order to modify our recommendations, as required. In addition, RGI requests to review the site grading plan, final design drawings and specifications when available to verify that our project understanding is correct and that our recommendations have been properly interpreted and incorporated into the project design and construction.

2.0 Project description

The project site is located at the southeast corner of the intersection of Station Drive and Dupont-Steilacoom Highway in Dupont, Washington. The approximate location of the site is shown on Figure 1.

RGI understands that the client plans to develop the existing property into two commercial lots. The proposed Starbucks Coffee building will be located at the north lot and a retail/commercial building will be built in the south lot in the future. Our understanding of the project is based on a preliminary site plan prepared by SCJ Alliance dated February 1, 2019.

At the time of preparing this GER, detailed building plans were not available for our review. Based on our experience with similar projects, RGI anticipates that the proposed buildings will be supported on perimeter walls with bearing loads of 1 to 2 kips per linear foot, and a series of columns with a maximum load up to 50 kips. Slab-on-grade floor loading of 150 pounds per square foot (psf) are expected. RGI also expects that minor grading will be needed to reach the final floor elevation.

3.0 Field Exploration and Laboratory Testing

3.1 Field Exploration

On March 8, 2019, RGI observed the excavation of 5 test pits to depths up to 8.5 feet bgs. The approximate exploration locations are shown on Figure 2.

Field logs of each exploration were prepared by the geologist that continuously observed the excavation. These logs included visual classifications of the materials encountered during excavation as well as our interpretation of the subsurface conditions between samples. The test pit logs included in Appendix A represent an interpretation of the field logs and include modifications based on laboratory observation and analysis of the samples.

3.2 LABORATORY TESTING

During the field investigation, a representative portion of each recovered sample was sealed in containers and transported to our laboratory for further visual and laboratory examination. Selected samples retrieved from the test pits were tested for moisture content and grain size analysis to aid in soil classification and provide input for the recommendations provided in this GER. The results and descriptions of the laboratory tests are enclosed in Appendix A.

4.0 Site Conditions

4.1 SURFACE

The subject site contains two irregular-shaped parcels of land totaling 1.86 acres in size. The site is bordered to the north and south by Station Drive, to the west by Dupont-Steilacoom Highway, and to the east by an existing commercial building.

The site contains a gravel parking area in the eastern portion of the property, and a grass slope in the western portion of the property. The site topography consists of a level area at the location of the parking lot, with a west-facing slope that descends to Dupont-Steilacoom Highway to the west. Slope gradients are less than 10 percent, with an overall elevation change of about 14 feet across the site. The site is vegetated with grass, with several medium-diameter trees along the north and south property lines.

4.2 GEOLOGY

Review of the *Geologic Map of the Tacoma 1:100,000-scale Quadrangle, Washington,* by J.E. Schuster, etc., (2015) indicates that the soil in the project vicinity is mapped as Recessional outwash, Steilacoom Gravel (Map Unit Qgo_{sg}), which is pebbles with boulders containing local crossbedding and kettles, deposited by glacial meltwater during glacier recession. These descriptions are generally similar to the native soils encountered during our field explorations.

4.3 SOILS

The soils encountered during field exploration includes up to 6 feet of fill comprised of loose to medium dense silty sandy gravel over native deposits of gravel with varying amounts of sand and silt.

More detailed descriptions of the subsurface conditions encountered are included in Appendix A. Sieve analysis was performed on four selected soil samples. Grain size distribution curves are included in Appendix A.

4.4 GROUNDWATER

Groundwater was not encountered during our subsurface exploration.

It should be recognized that fluctuations of the groundwater table will occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the explorations were performed. In addition, perched water can develop within seams and layers contained in fill soils or higher permeability soils overlying less permeable soils following periods of heavy or prolonged precipitation. Therefore, groundwater levels during construction or at other times in the future may be higher or lower than the levels indicated on the logs. Given the time of the field exploration was performed, RGI expects that the groundwater level is near the seasonal-high level.

4.5 SEISMIC CONSIDERATIONS

Based on the 2012/2015 International Building Code (IBC), RGI recommends the follow seismic parameters in Table 1 be used for design.

Table 1 IBC Seismic Parameters

2012/2015 IBC Parameter	Value
Site Soil Class[1]	D[2]
Site Latitude	47.09503 N
Site Longitude	122.62251 W
Maximum considered earthquake spectral response acceleration parameters (g)	S_s =1.296, S_1 =0.515
Spectral response acceleration parameters adjusted for site class (g)	S_{ms} =1.296, S_{m1} =0.773
Design spectral response acceleration parameters (g)	S_{ds} =0.864, S_{d1} =0.515

1 Note: In general accordance with the USGS *2012/2015 International Building Code*. IBC Site Class is based on the average characteristics of the upper 100 feet of the subsurface profile.

2 Note: The *2012/2015 International Building Code* requires a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope of our services does not include the required 100 foot soil profile determination. Test pits extended to a maximum depth of 8.5 feet, and this seismic site class definition considers that similar soil continues below the maximum depth of the subsurface exploration.

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in water pressure induced by vibrations from a seismic event. Liquefaction mainly affects geologically recent deposits of fine-grained sands that are below the groundwater table. Soils of this nature derive their strength from intergranular friction. The generated water pressure or pore pressure essentially separates the soil grains and eliminates this intergranular friction, thus reducing or eliminating the soil's strength.

RGI reviewed the results of the field and laboratory testing and assessed the potential for liquefaction of the site's soil during an earthquake. Due to the absence of a shallow groundwater table and gradation of the native deposits, RGI considers that the possibility of liquefaction during an earthquake is low.

4.6 GEOLOGIC HAZARD AREAS

Regulated geologically hazardous areas include erosion, landslide, earthquake, or other geological hazards. RGI reviewed the Dupont Municipal Code (Chapter 25.105.050); the site does not contain geologically hazardous areas.

5.0 Discussion and Recommendations

5.1 GEOTECHNICAL CONSIDERATIONS

Based on our study, the site is suitable for the proposed construction from a geotechnical standpoint. Foundations for the proposed building can be supported on conventional spread footings bearing on the existing fill or new structural fill if needed. Slab-on-grade and pavements can be similarly supported.

Detailed recommendations regarding the above issues and other geotechnical design considerations are provided in the following sections. These recommendations should be incorporated into the final design drawings and construction specifications.

5.2 EARTHWORK

At the time of preparing this report, a site grading plan was not available. Since the existing site has been graded before with up to 6 feet of fill, RGI expects that additional grading activities will be needed for the site. The expected earthwork will consist of placing additional structural fill, overexcavating the building footprints if necessary, installing underground utilities and preparing pavement subgrades.

5.2.1 EROSION AND SEDIMENT CONTROL

Potential sources or causes of erosion and sedimentation depend on construction methods, slope length and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. The impacts on erosion-prone areas can be

reduced by implementing an erosion and sedimentation control plan. The plan should be designed in accordance with applicable city and/or county standards.

RGI recommends the following erosion control Best Management Practices (BMPs):

- Scheduling site preparation and grading for the drier summer and early fall months and undertaking activities that expose soil during periods of little or no rainfall
- Retaining existing vegetation whenever feasible
- Establishing a quarry spall construction entrance
- Installing siltation control fencing or anchored straw or coir wattles on the downhill side of work areas
- Covering soil stockpiles with anchored plastic sheeting
- Revegetating or mulching exposed soils with a minimum 3-inch thickness of straw if surfaces will be left undisturbed for more than 1 day during wet weather or 1 week in dry weather
- Directing runoff away from exposed soils and slopes
- Minimizing the length and steepness of slopes with exposed soils and cover excavation surfaces with anchored plastic sheeting (Graded and disturbed slopes should be tracked in place with the equipment running perpendicular to the slope contours so that the track marks provide a texture to help resist erosion and channeling. Some sloughing and raveling of slopes with exposed or disturbed soil should be expected.)
- Decreasing runoff velocities with check dams, straw bales or coir wattles
- Confining sediment to the project site
- Inspecting and maintaining erosion and sediment control measures frequently (The contractor should be aware that inspection and maintenance of erosion control BMPs is critical toward their satisfactory performance. Repair and/or replacement of dysfunctional erosion control elements should be anticipated.)

Permanent erosion protection should be provided by reestablishing vegetation using hydroseeding and/or landscape planting. Until the permanent erosion protection is established, site monitoring should be performed by qualified personnel to evaluate the effectiveness of the erosion control measures. Provisions for modifications to the erosion control system based on monitoring observations should be included in the erosion and sedimentation control plan.

5.2.2 STRIPPING

Stripping efforts should include removal of vegetation, organic materials, and deleterious debris from areas slated for building, pavement, and utility construction. Based on the

site conditions, we anticipate stripping depths of approximately 6 inches in the grass areas of the site. Deeper areas of stripping may be required in heavily vegetated areas of the site.

5.2.3 EXCAVATIONS

All temporary cut slopes associated with the site and utility excavations should be adequately inclined to prevent sloughing and collapse. Based on OSHA regulations, the native soil classifies as a Group C soil.

Accordingly, for excavations more than 4 feet but less than 20 feet in depth, the temporary side slopes should be laid back with a minimum slope inclination of 1.5H:1V (horizontal:vertical) in native soil. If there is insufficient room to complete the excavations in this manner, or excavations greater than 20 feet in depth are planned, using temporary shoring to support the excavations should be considered. For open cuts at the site, RGI recommends:

- No traffic, construction equipment, stockpiles or building supplies are allowed at the top of cut slopes within a distance of at least 5 feet from the top of the cut.
- Exposed soil along the slope is protected from surface erosion using waterproof tarps and/or plastic sheeting.
- Construction activities are scheduled so that the length of time the temporary cut is left open is minimized.
- Surface water is diverted away from the excavation.
- The general condition of slopes should be observed periodically by a geotechnical engineer to confirm adequate stability and erosion control measures.

In all cases, however, appropriate inclinations will depend on the actual soil and groundwater conditions encountered during earthwork. Ultimately, the site contractor must be responsible for maintaining safe excavation slopes that comply with applicable OSHA or WISHA guidelines.

5.2.4 SITE PREPARATION

RGI anticipates that some areas of loose soil may be exposed upon completion of stripping and grubbing. Proofrolling and subgrade verification should be considered an essential step in site preparation. After stripping, grubbing, and prior to placement of structural fill, RGI recommends proofrolling building and pavement subgrades and areas to receive structural fill. These areas should be proofrolled under the observation of RGI and compacted to a firm and unyielding condition in order to achieve a minimum compaction level of 95 percent of the modified proctor maximum dry density as determined by the American Society of Testing and Materials D1557-09 Standard Test

Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (ASTM D1557).

Proofrolling and adequate subgrade compaction can only be achieved when the soils are within approximately ± 2 percent moisture content of the optimum moisture content. Soils which appear firm after stripping and grubbing may be proofrolled with a heavy compactor, loaded double-axle dump truck, or other heavy equipment under the observation of an RGI representative. This observer will assess the subgrade conditions prior to filling. The need for or advisability of proofrolling due to soil moisture conditions should be determined at the time of construction.

Subgrade soils that become disturbed due to elevated moisture conditions should be overexcavated to reveal firm, non-yielding, non-organic soils and backfilled with compacted structural fill. In order to maximize utilization of site soils as structural fill, RGI recommends that the earthwork portion of this project be completed during extended periods of warm and dry weather if possible. If earthwork is completed during the wet season (typically November through May) it will be necessary to take extra precautionary measures to protect subgrade soils. Wet season earthwork will require additional mitigative measures beyond what would be expected during the drier summer and fall months.

5.2.5 STRUCTURAL FILL

RGI recommends fill below the foundation and floor slab, behind retaining walls, and below pavement and hardscape surfaces be placed in accordance with the following recommendations for structural fill. The structural fill should be placed after completion of site preparation procedures as described above.

RGI recommends placing structural fill in lifts not exceeding 12 inches in loose thickness and thoroughly compacted as specified in Table 3. The suitability of soils for compacted structural fill use will depend on the gradation and moisture content of the soil when it is placed. As the amount of fines (that portion passing the US. No. 200 sieve) increases, soil becomes increasingly sensitive to small changes in moisture content and adequate compaction becomes more difficult or impossible to achieve. Soils containing more than about 5 percent fines cannot be consistently compacted to a dense, non-yielding condition when the moisture content is more than 2 percent above or below optimum. Optimum moisture content is that moisture which results in the greatest compacted dry density with a specified compactive effort.

The onsite soil may be suitable for use as structural fill if the moisture can be property controlled. If the construction occurs in wet weather conditions, import structural fill may be necessary for grading and backfill. The import or the existing native soils must meet

the grading requirements listed in Table 2 in order to be used as structural fill in wet weather.

Table 2 Structural Fill Gradation

U.S. Sieve Size	Percent Passing
4 inches	100
No. 4 sieve	75 percent
No. 200 sieve	5 percent *

*Based on minus 3/4 inch fraction.

Prior to use, an RGI representative should observe and test all materials imported to the site for use as structural fill. Structural fill materials should be placed in uniform loose layers not exceeding 12 inches and compacted as specified in Table 3. The soil's maximum density and optimum moisture should be determined by ASTM D1557.

Table 3 Structural Fill Compaction ASTM D1557

Location	Material Type	Minimum Compaction Percentage	Moisture Content Range	
Foundations	On-site granular or approved imported fill soils:	95	+2	-2
Retaining Wall Backfill	On-site granular or approved imported fill soils:	92	+2	-2
Slab-on-grade	On-site granular or approved imported fill soils:	95	+2	-2
General Fill (non-structural areas)	On-site granular or approved imported fill soils:	90	+3	-2
Pavement – Subgrade and Base Course	On-site granular or approved imported fill soils:	95	+2	-2

Placement and compaction of structural fill should be observed by RGI. A representative number of in-place density tests should be performed as the fill is being placed to confirm that the recommended level of compaction is achieved.

5.2.6 Wet Weather Construction Considerations

RGI recommends that preparation for site grading and construction include procedures intended to drain ponded water, control surface water runoff, and to collect shallow subsurface seepage zones in excavations, where encountered. It will not be possible to successfully compact the subgrade or utilize on-site soils as structural fill if accumulated water is not drained prior to grading or if drainage is not controlled during construction.

Attempting to grade the site without adequate drainage control measures will reduce the amount of on-site soil effectively available for use, increase the amount of select import fill materials required, and ultimately increase the cost of the earthwork phases of the project. Free water should not be allowed to pond on the subgrade soils. RGI anticipates that the use of berms and shallow drainage ditches, with sumps and pumps in utility trenches, will be required for surface water control during wet weather and/or wet site conditions.

5.3 FOUNDATIONS

Following site preparation and grading, the proposed foundation can be supported on the existing fill or new structural fill used to modify site grades. The suitability of the existing fill should be evaluated prior to using as foundation support. If loose existing fills are encountered at foundation subgrade, we expect it will be feasible to moisture condition and compact the soils to provide foundation support.

Perimeter foundations exposed to weather should be at a minimum depth of 18 inches below final exterior grades. Interior foundations can be constructed at any convenient depth below the floor slab. Finished grade is defined as the lowest adjacent grade within 5 feet of the foundation for perimeter (or exterior) footings and finished floor level for interior footings.

Table 4 Foundation Design

Design Parameter	Value
Allowable Bearing Capacity	2,500 psf[1]
Friction Coefficient	0.3
Passive pressure (equivalent fluid pressure)	250 pcf[2]
Minimum foundation dimensions	Columns: 24 inches Walls: 16 inches

[1]. psf = pounds per square foot

[2]. pcf = pounds per cubic foot

The allowable foundation bearing pressures apply to dead loads plus design live load conditions. For short-term loads, such as wind and seismic, a 1/3 increase in this allowable capacity may be used. At perimeter locations, RGI recommends not including the upper 12 inches of soil in the computation of passive pressures because they can be affected by weather or disturbed by future grading activity. The passive pressure value assumes the foundation will be constructed neat against competent soil or backfilled with structural fill as described in Section 5.2.5. The recommended base friction and passive resistance value includes a safety factor of about 1.5.

With spread footing foundations designed in accordance with the recommendations in this section, maximum total and differential post-construction settlements of 1 inch and 1/2 inch, respectively, should be expected.

5.4 RETAINING WALLS

If retaining walls are needed for grade transitions at the site in building areas, RGI recommends cast-in-place concrete walls be used. The footing should be supported on structural fill. The suitability of the existing fill should be evaluated prior to using as foundation support. If loose existing fills are encountered, we expect it will be feasible to moisture condition and compact the soils to provide foundation support for retaining walls.

The magnitude of earth pressure development on retaining walls will partly depend on the quality of the wall backfill. RGI recommends placing and compacting wall backfill as structural fill. Wall drainage will be needed behind the wall face. A typical retaining wall drainage detail is shown on Figure 3.

With wall backfill placed and compacted as recommended, and drainage properly installed, RGI recommends using the values in the following table for design.

Table 5 Retaining Wall Design

Design Parameter	Value
Allowable Bearing Capacity	2,500 psf
Active Earth Pressure (unrestrained walls)	35 pcf
At-rest Earth Pressure (restrained walls)	50 pcf

For seismic design, an additional uniform load of 7 times the wall height (H) for unrestrained walls and 14H for restrained walls should be applied to the wall surface. Friction at the base of foundations and passive earth pressure will provide resistance to these lateral loads. Values for these parameters are provided in Section 5.3.

5.5 SLAB-ON-GRADE CONSTRUCTION

Once site preparation has been completed as described in Section 5.2, slab-on-grade construction can be supported on existing fill or new structural fill. Immediately below the floor slab, RGI recommend placing a 4-inch-thick capillary break layer of clean, free-draining sand or gravel that has less than 5 percent passing the U.S. No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slab.

Where moisture by vapor transmission is undesirable, an 8- to 10-millimeter-thick plastic membrane should be placed on a 4-inch-thick layer of clean gravel. For the anticipated floor slab loading, RGI estimates post-construction floor settlements of 1/4- to 1/2-inch. For thickness design of the slab subjected to point loading from storage racks, RGI recommends using a subgrade modulus (Ks) of 150 pounds per square inch per inch of deflection.

5.6 DRAINAGE

5.6.1 SURFACE

Final exterior grades should promote free and positive drainage away from the building area. Water must not be allowed to pond or collect adjacent to foundations or within the immediate building area. For non-pavement locations, RGI recommends providing a minimum drainage gradient of 3 percent for a minimum distance of 10 feet from the building perimeter. In paved locations, a minimum gradient of 1 percent should be provided unless provisions are included for collection and disposal of surface water adjacent to the structure.

5.6.2 SUBSURFACE

Perimeter foundation drains shown on Figure 4 are typically installed around the perimeter of the buildings. Based on the free draining nature of the soils, the footing drain may be eliminated if the area around the building is sidewalk or pavement and the foundations are supported on the existing gravel soils or free-draining imported soils.

The foundation drains and roof downspouts should be tightlined separately to an approved discharge facility. Subsurface drains must be laid with a gradient sufficient to promote positive flow to a controlled point of approved discharge.

5.6.3 INFILTRATION

RGI performed an infiltration tests at 7.5 feet below the existing ground surface at Test Pit TP-1 with an area of approximately 12 square feet (3 by 4 feet). The soil at the infiltration elevation is gravel with some sand and trace silt, containing about 5% fines.

The infiltration test was generally following pilot infiltration test (PIT) test methods. The results of the tests are provided below.

Table 6 Measured Infiltration Rates

Test Location	Approximate Depth of Test (feet)	Measured Rate (inches/hour)	Native Soil at Infiltration Depth
TP-1	7.5	95	Gravel

A field rate of 95 inches per hour was obtained, however the variability of the soil and groundwater conditions requires careful siting of infiltration systems.

In accordance with the 2012 Stormwater Management Manual for Western Washington by Washington State Department of Ecology as amended in December 2014 Table 3.3.1, we recommend using a correction factors of CFt=0.5 for the small scale PIT test, CFv=0.33 and CFm=0.9 which yields a Total Correction Factor (CF_T) of 0.149. Applying the CF_T to the field measured infiltration rate yields a design rate of 14.2 inches per hour for design of the infiltration systems.

We recommend RGI be contacted to review the proposed infiltration locations and depths. Depending on the design, it may be necessary to complete additional testing. In addition, it is proposed to place structural fill over the existing ground surface and infiltration facilities may be located in the fill soils. Specific recommendations for the gradation and placement of fill underlying the systems will need to be provided and verified prior to the installation of the systems.

5.7 UTILITIES

Utility pipes should be bedded and backfilled in accordance with American Public Works Association (APWA) specifications. For site utilities located within the right-of-ways, bedding and backfill should be completed in accordance with Pierce County and the City of Dupont specifications. At a minimum, trench backfill should be placed as structural fill, as described in Section 5.2.5 and compacted to at least 95 percent of the maximum dry density per ASTM D1557. Where utilities occur below unimproved areas, the degree of compaction can be reduced to a minimum of 90 percent of the soil's maximum density as determined by ASTM D1557. As discussed above, the native soils can reused as structural fill if the construction occurs in summer months.

5.8 PAVEMENTS

Pavement subgrades should be prepared as described in Section 4.2 and as discussed below. Regardless of the relative compaction achieved, the subgrade must be firm and relatively unyielding before paving. The subgrade should be proofrolled with heavy construction equipment to verify this condition.

With the pavement subgrade prepared as described above, RGI recommends the following pavement sections for parking and drive areas paved with flexible asphalt concrete surfacing.

- **For general parking**: 3 inches of hot mix asphalt (HMA) over 6 inches of crushed rock base (CRB)
- **For driveway and heavy traffic area**: 4 inches of HMA over 8 inches of CRB

The asphalt paving materials used should conform to the Washington State Department of Transportation (WSDOT) specifications for Hot Mix Asphalt Class 1/2 inch and CRB surfacing.

If concrete pavement is preferred, the following pavement section can be used.

- **For heavy duty concrete pavement areas**: 6 inches of concrete over 4 inches of CRB
- **For standard duty concrete pavement areas**: 5 inches of concrete over 4 inches of CRB

Long-term pavement performance will depend on surface drainage. A poorly-drained pavement section will be subject to premature failure as a result of surface water infiltrating into the subgrade soils and reducing their supporting capability.

For optimum pavement performance, surface drainage gradients of no less than 2 percent are recommended. Also, some degree of longitudinal and transverse cracking of the pavement surface should be expected over time. Regular maintenance should be planned to seal cracks when they occur.

6.0 Additional Services

RGI is available to provide further geotechnical consultation throughout the design phase of the project. RGI should review the final design and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and incorporated into project design and construction.

RGI is also available to provide geotechnical engineering and construction monitoring services during construction. The integrity of the earthwork and construction depends on proper site preparation and procedures. In addition, engineering decisions may arise in the field in the event that variations in subsurface conditions become apparent. Construction monitoring services are not part of this scope of work. If these services are desired, please let us know and we will prepare a cost proposal.

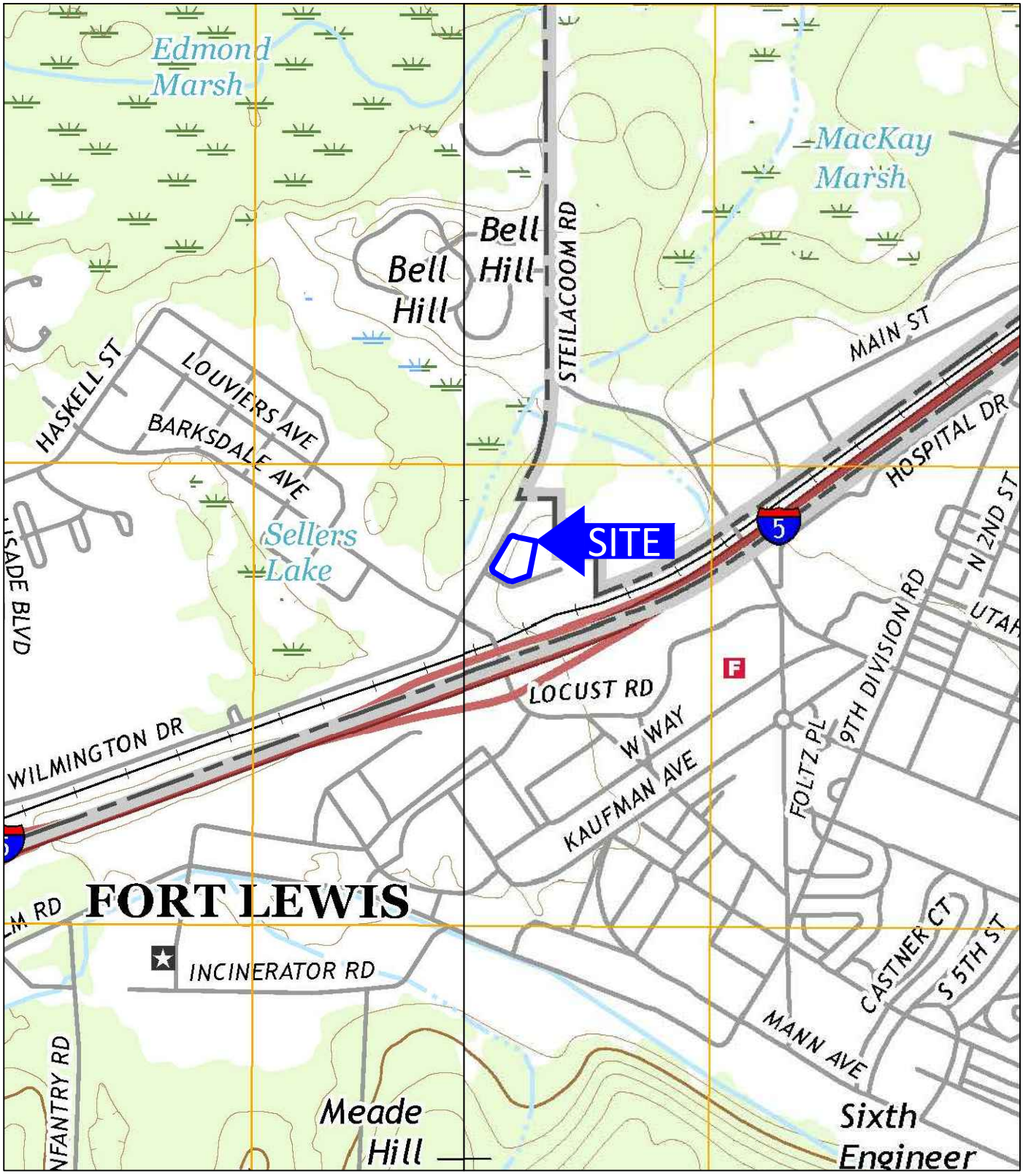
7.0 Limitations

This report is the property of RGI, Stephen Kern and his designated agents. Within the limits of the scope and budget, this report was prepared in accordance with generally accepted geotechnical engineering practices in the area at the time this report was issued. This report is intended for specific application to Proposed Starbucks Coffee at the southeast corner Station Drive and Dupont-Steilacoom Highway in Dupont, Washington, and for the exclusive use of Stephen Kern and his authorized representatives. No other warranty, expressed or implied, is made. Site safety, excavation support, and dewatering requirements are the responsibility of others.

The scope of services for this project does not include either specifically or by implication any environmental or biological (for example, mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions.

The analyses and recommendations presented in this report are based upon data obtained from the explorations performed on-site. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, RGI should be requested to reevaluate the recommendations in this report prior to proceeding with construction.

It is the client's responsibility to see that all parties to the project, including the designers, contractors, subcontractors, are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.



USGS, 2017, Nisqually, Washington
USGS, 2017, Fort Lewis, Washington
7.5-Minute Quadrangle

Approximate Scale: 1"=1000'

0 500 1000 2000

N

RILEYGROUP
Corporate Office
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Dupont Starbucks Coffee		Figure 1
RGI Project Number: 2019-032	Site Vicinity Map	Date Drawn: 03/2019
Address: SEC Station Dr. and Dupont-Steilacoom Hwy., Dupont, Washington 98327		

Approximate Scale: 1"=60'

0 30 60 120

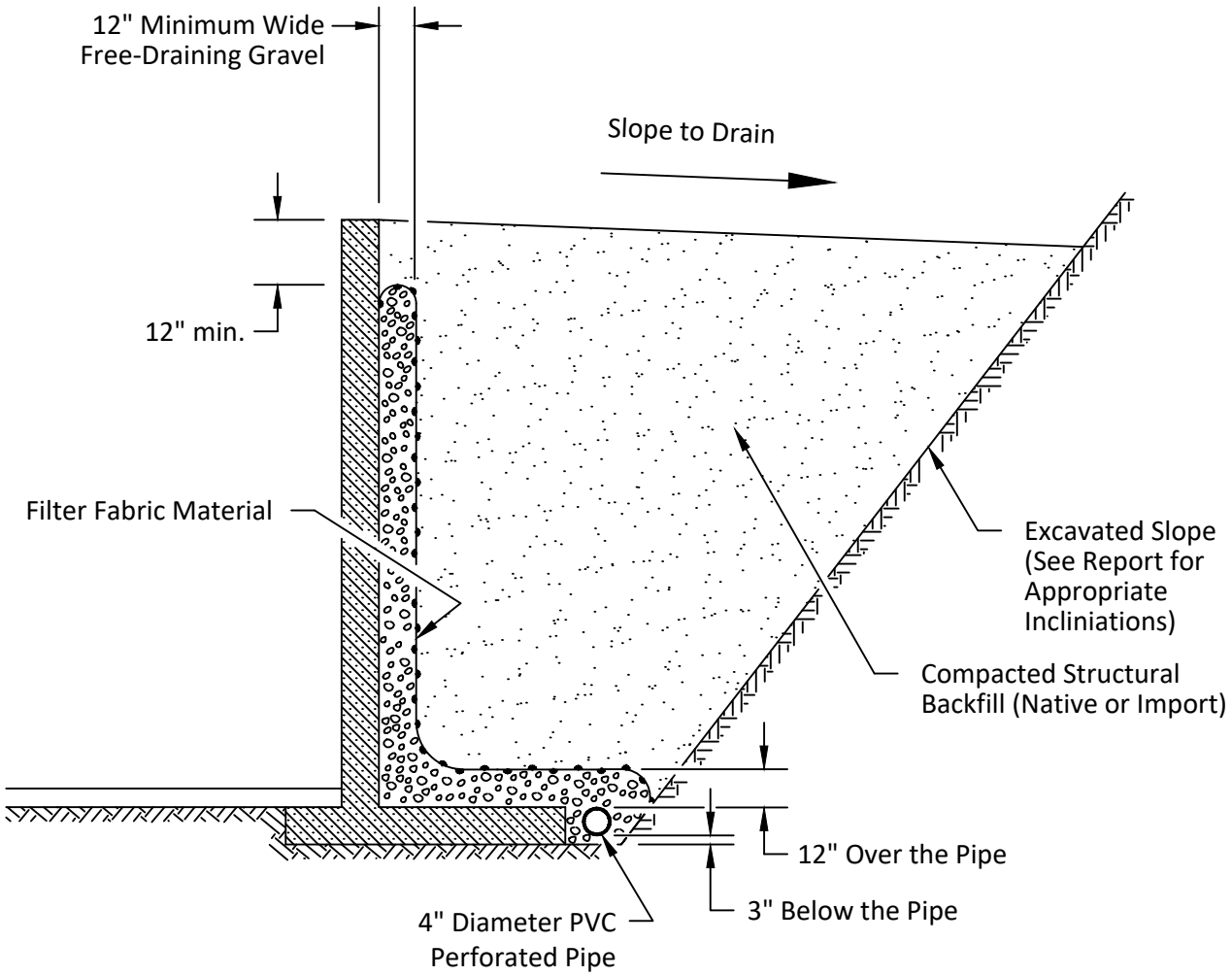
N

= Test pit by RGI, 3/8/19

= Site boundary

RILEYGROUP
Corporate Office
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

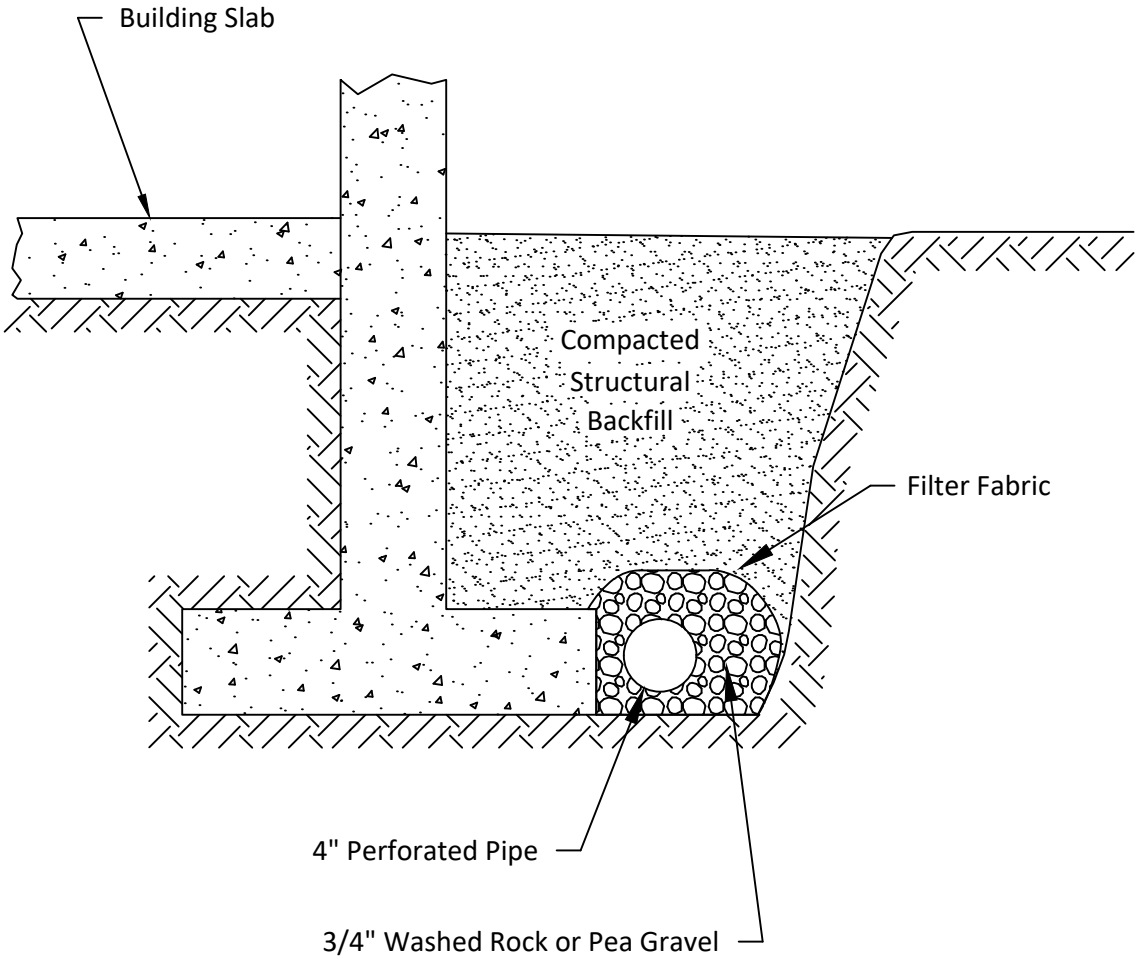
Dupont Starbucks Coffee		Figure 2
RGI Project Number: 2019-032	Geotechnical Exploration Plan	Date Drawn: 03/2019
Address: SEC Station Dr. and Dupont-Steilacoom Hwy., Dupont, Washington 98327		



Not to Scale

RILEYGROUP
Corporate Office
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Dupont Starbucks Coffee		Figure 3
RGI Project Number: 2019-032	Retaining Wall Drainage Detail	Date Drawn: 03/2019
Address: SEC Station Dr. and Dupont-Steilacoom Hwy., Dupont, Washington 98327		



Not to Scale

RILEYGROUP
Corporate Office
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Dupont Starbucks Coffee		Figure 4
RGI Project Number: 2019-032	Typical Footing Drain Detail	Date Drawn: 03/2019
Address: SEC Station Dr. and Dupont-Steilacoom Hwy., Dupont, Washington 98327		

APPENDIX A
FIELD EXPLORATION AND LABORATORY TESTING

On March 8, 2019, RGI explored the subsurface soil conditions at the site by observing the excavation of 5 test pits to a maximum depth of 8.5 feet below existing grade. The test pit locations are shown on Figure 2. The test pit locations were approximately determined by measurements from existing property lines and paved roads.

A geologist from our office conducted the field exploration and classified the soil conditions encountered, maintained a log of each test exploration, obtained representative soil samples, and observed pertinent site features. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS) described in Appendix A.

Representative soil samples obtained from the explorations were placed in closed containers and taken to our laboratory for further examination and testing. As a part of the laboratory testing program, the soil samples were classified in our in-house laboratory based on visual observation, texture, and the limited laboratory testing described below.

Moisture Content Determinations

Moisture content determinations were performed in accordance with the American Society of Testing and Materials D2216-10 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass (ASTM D2216) on representative samples obtained from the exploration in order to aid in identification and correlation of soil types. The moisture content of typical sample was measured and is reported on the test pit logs.

Grain Size Analysis

A grain-size analysis indicates the range in diameter of soil particles included in a particular sample. Grain size analyses for the greater than 75 micrometer portion of the samples were performed in accordance with American Society of Testing and Materials D422 Standard Test Method for Particle-Size Analysis of Soils (ASTM D422) on four of the samples.

Project Name: **Dupont Starbucks Coffee**
Project Number: **2019-032**
Client: **Stephen Kern**

RILEYGROUP

Test Pit No.: TP-1

Sheet 1 of 1

Date(s) Excavated: **3/8/2019**	Logged By **ELW**	Surface Conditions: **Gravel**
Excavation Method: **Test Pit**	Bucket Size: **N/A**	Total Depth of Excavation: **8.5 feet bgs**
Excavator Type: **Rubber Tired Backhoe**	Excavating Contractor: **Kelly's Excavating**	Approximate Surface Elevation **N/A**
Groundwater Level: **Not Encountered**	Sampling Method(s) **Grab**	Compaction Method **Bucket**
Test Pit Backfill: **Cuttings**	Location **Southeast Corner of Station Drive and Dupont-Steilacoom Highway, Dupont, Washington**	

Depth (feet)	Sample Type	Sample Number	USCS Symbol	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
0			Fill	4" of 5/8" minus crushed rock	
			GP	Dark brown GRAVEL with some sand and trace silt, medium dense, moist	5% moisture, 3% fines
			GW	Brown GRAVEL with some sand, medium dense, moist	3% moisture, 0% fines
				Moderate caving	
5			GP	Brown GRAVEL with some sand and trace silt, medium dense, moist	3% moisture, 2% fines
				Infiltration test conducted at 7.5'	
			GW	Brown GRAVEL with some sand and trace silt, medium dense, moist	5% moisture, 5% fines
10				Test Pit terminated at 8.5' due to caving	

The Riley Group, Inc.
17522 Bothell Way NE, Bothell, WA 98011

Project Name: **Dupont Starbucks Coffee**
Project Number: **2019-032**
Client: **Stephen Kern**

RILEYGROUP

Test Pit No.: TP-2

Sheet 1 of 1

Date(s) Excavated: **3/8/2019**	Logged By **ELW**	Surface Conditions: **Grass**
Excavation Method: **Test Pit**	Bucket Size: **N/A**	Total Depth of Excavation: **7 feet bgs**
Excavator Type: **Rubber Tired Backhoe**	Excavating Contractor: **Kelly's Excavating**	Approximate Surface Elevation **N/A**
Groundwater Level: **Not Encountered**	Sampling Method(s) **Grab**	Compaction Method **Bucket**
Test Pit Backfill: **Cuttings**	Location **Southeast Corner of Station Drive and Dupont-Steilacoom Highway, Dupont, Washington**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0			Fill		Black silty sandy GRAVEL, loose to medium dense, moist (Fill) Contains organics	
				Fill		Gray silty sandy GRAVEL, medium dense, moist (Fill) Trace construction debris	4% moisture
	5			GP		Brown GRAVEL with some sand and trace silt, medium dense, moist	3% moisture
						Test Pit terminated at 7'	
	10						

The Riley Group, Inc.
17522 Bothell Way NE, Bothell, WA 98011

Project Name: **Dupont Starbucks Coffee**
Project Number: **2019-032**
Client: **Stephen Kern**

RILEYGROUP

Test Pit No.: TP-3

Sheet 1 of 1

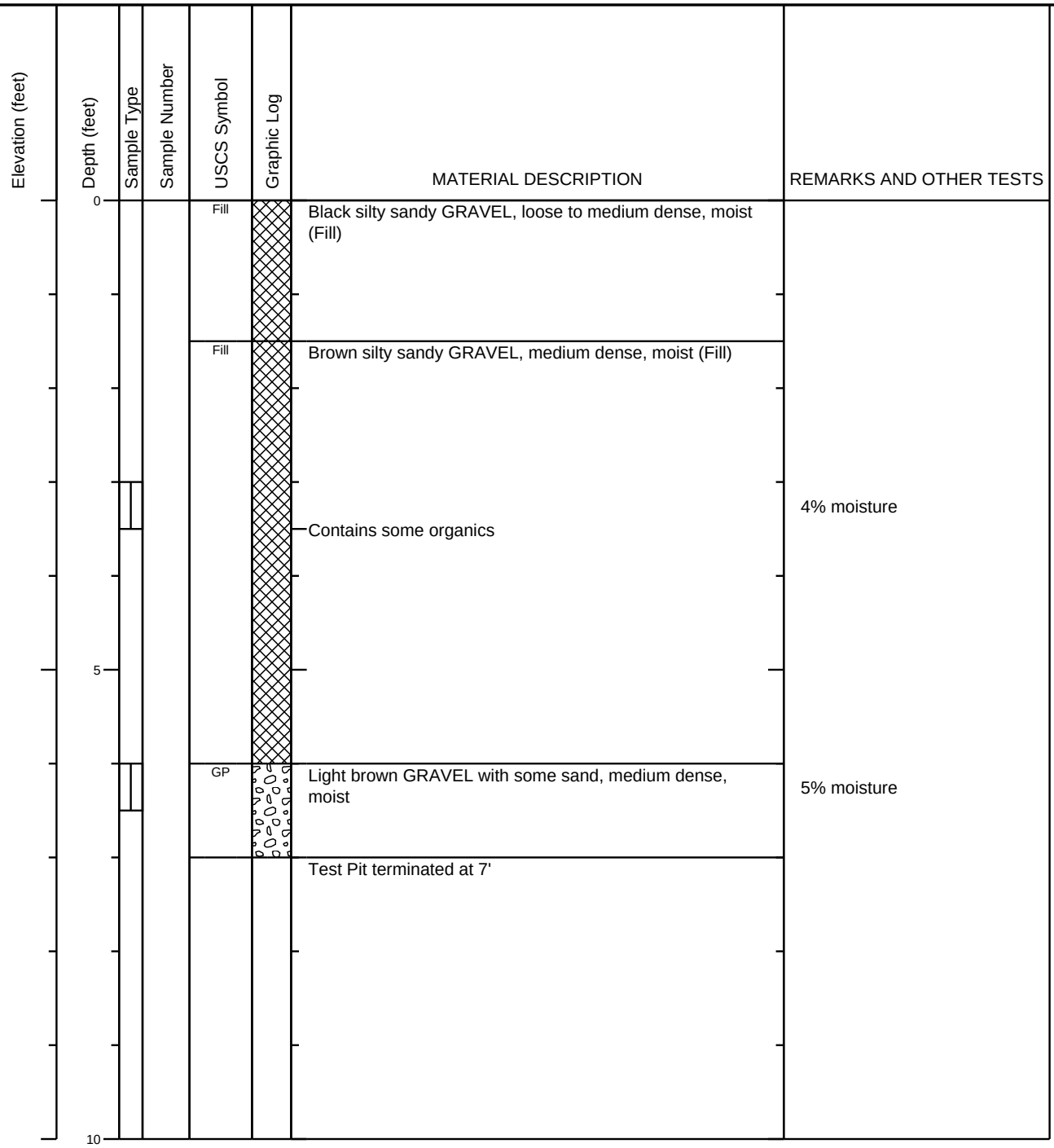
Date(s) Excavated: **3/8/2019**	Logged By **ELW**	Surface Conditions: **Grass**
Excavation Method: **Test Pit**	Bucket Size: **N/A**	Total Depth of Excavation: **6.5 feet bgs**
Excavator Type: **Rubber Tired Backhoe**	Excavating Contractor: **Kelly's Excavating**	Approximate Surface Elevation **N/A**
Groundwater Level: **Not Encountered**	Sampling Method(s) **Grab**	Compaction Method **Bucket**
Test Pit Backfill: **Cuttings**	Location **Southeast Corner of Station Drive and Dupont-Steilacoom Highway, Dupont, Washington**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0			Fill		Black silty sandy GRAVEL, loose to medium dense, moist (Fill) Contains organics	
				Fill		Brown silty sandy GRAVEL, medium dense, moist (Fill)	2% moisture
	5			GP-GM		Brown GRAVEL with some sand and silt, medium dense, moist	5% moisture
						Test Pit terminated at 6.5'	
	10						

The Riley Group, Inc.
17522 Bothell Way NE, Bothell, WA 98011

Project Name: **Dupont Starbucks Coffee** Project Number: **2019-032** Client: **Stephen Kern**	RILEYGROUP Test Pit No.: TP-4 **Sheet 1 of 1**

Date(s) Excavated: **3/8/2019**	Logged By **ELW**	Surface Conditions: **Grass**
Excavation Method: **Test Pit**	Bucket Size: **N/A**	Total Depth of Excavation: **7 feet bgs**
Excavator Type: **Rubber Tired Backhoe**	Excavating Contractor: **Kelly's Excavating**	Approximate Surface Elevation **N/A**
Groundwater Level: **Not Encountered**	Sampling Method(s) **Grab**	Compaction Method **Bucket**
Test Pit Backfill: **Cuttings**	Location **Southeast Corner of Station Drive and Dupont-Steilacoom Highway, Dupont, Washington**	



The Riley Group, Inc.
17522 Bothell Way NE, Bothell, WA 98011

Project Name: **Dupont Starbucks Coffee**
Project Number: **2019-032**
Client: **Stephen Kern**

RILEYGROUP

Test Pit No.: TP-5

Sheet 1 of 1

Date(s) Excavated: **3/8/2019**	Logged By **ELW**	Surface Conditions: **Gravel**
Excavation Method: **Test Pit**	Bucket Size: **N/A**	Total Depth of Excavation: **6.5 feet bgs**
Excavator Type: **Rubber Tired Backhoe**	Excavating Contractor: **Kelly's Excavating**	Approximate Surface Elevation **N/A**
Groundwater Level: **Not Encountered**	Sampling Method(s) **Grab**	Compaction Method **Bucket**
Test Pit Backfill: **Cuttings**	Location **Southeast Corner of Station Drive and Dupont-Steilacoom Highway, Dupont, Washington**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0			Fill		4" of 5/8" minus crushed rock	
				Fill		Dark brown silty sandy GRAVEL, medium dense, moist (Fill)	5% moisture
				GP		Brown GRAVEL with some sand and trace silt, medium dense, moist	5% moisture
	5						5% moisture
						Test Pit terminated at 6.5'	
	10						

The Riley Group, Inc.
17522 Bothell Way NE, Bothell, WA 98011

Project Name: **Dupont Starbucks Coffee**
Project Number: **2019-032**
Client: **Stephen Kern**

RILEYGROUP

Key to Logs

Sheet 1 of 1

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8

COLUMN DESCRIPTIONS

1. Elevation (feet): Elevation (MSL, feet).
2. Depth (feet): Depth in feet below the ground surface.
3. Sample Type: Type of soil sample collected at the depth interval shown.
4. Sample Number: Sample identification number.
5. USCS Symbol: USCS symbol of the subsurface material.
6. Graphic Log: Graphic depiction of the subsurface material encountered.
7. MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
8. REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

AF
Poorly graded GRAVEL (GP)
Poorly graded GRAVEL with Silt (GP-GM)
Well graded GRAVEL (GW)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Auger sampler
Bulk Sample
3-inch-OD California w/ brass rings
CME Sampler
Grab Sample
2.5-inch-OD Modified California w/ brass liners
Pitcher Sample
2-inch-OD unlined split spoon (SPT)
Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)
Water level (after waiting)
Minor change in material properties within a stratum
Inferred/gradational contact between strata
Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

THE RILEY GROUP, INC.
17522 Bothell Way NE
Bothell, WA 98011

PHONE: (425) 415-0551
FAX: (425) 415-0311

GRAIN SIZE ANALYSIS
ASTM D421, D422, D1140, D2487, D6913

PROJECT TITLE	Dupont Starbucks Coffee		**SAMPLE ID/TYPE**	TP-1	
PROJECT NO.	2019-032		**SAMPLE DEPTH**	1'	
TECH/TEST DATE	ELW	3/8/2019	**DATE RECEIVED**	3/8/2019	

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	588.2
Wt Dry Soil & Tare (gm)	(w2)	562.4
Weight of Tare (gm)	(w3)	16.0
Weight of Water (gm)	(w4=w1-w2)	25.8
Weight of Dry Soil (gm)	(w5=w2-w3)	546.4
Moisture Content (%)	(w4/w5)*100	5

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

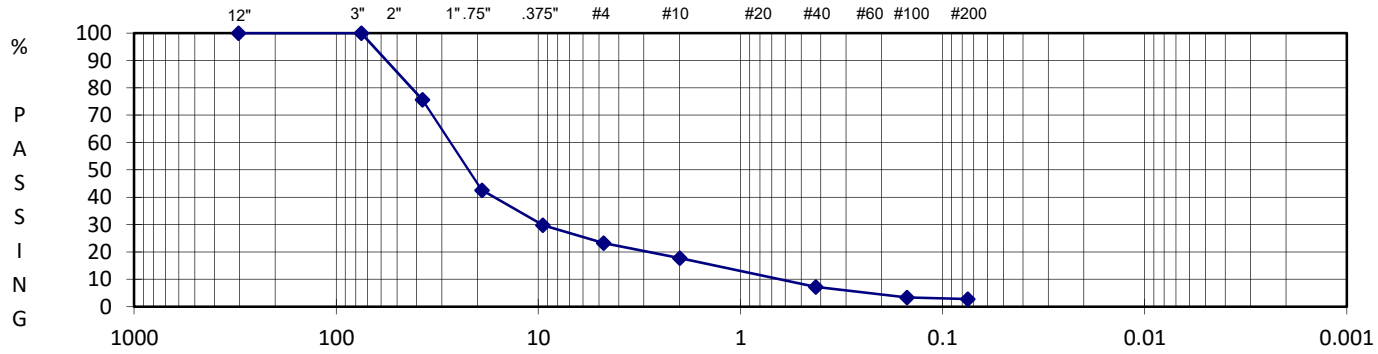
Weight Of Sample (gm)		562.4
Tare Weight (gm)		16.0
Total Dry Weight (gm)	(W6)	546.4

% COBBLES	**0.0**
% C GRAVEL	**57.4**
% F GRAVEL	**19.3**
% C SAND	**5.5**
% M SAND	**10.5**
% F SAND	**4.5**
% FINES	**2.8**
% TOTAL	**100.0**

D10 (mm)	0.6
D30 (mm)	9.5
D60 (mm)	28
Cu	46.7
Cc	5.4

SIEVE ANALYSIS

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	16.0	0.00	0.00	100.00	cobbles
3.0"	16.0	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"					coarse gravel
1.5"	148.9	132.90	24.32	75.68	coarse gravel
1.0"					coarse gravel
0.75"	329.9	313.90	57.45	42.55	fine gravel
0.50"					fine gravel
0.375"	399.4	383.40	70.17	29.83	fine gravel
#4	435.2	419.20	76.72	23.28	coarse sand
#10	465.0	449.00	82.17	17.83	medium sand
#20					medium sand
#40	522.6	506.60	92.72	7.28	fine sand
#60					fine sand
#100	543.7	527.70	96.58	3.42	fine sand
#200	547.0	531.00	97.18	2.82	fines
PAN	562.4	546.40	100.00	0.00	silt/clay



DESCRIPTION	GRAVEL with some sand and trace silt
USCS	GP

Prepared For:
Partners Architecture Design Group, Inc.

Reviewed By:
RW

RILEYGROUP

THE RILEY GROUP, INC.
17522 Bothell Way NE
Bothell, WA 98011

PHONE: (425) 415-0551
FAX: (425) 415-0311

GRAIN SIZE ANALYSIS
ASTM D421, D422, D1140, D2487, D6913

PROJECT TITLE	Dupont Starbucks Coffee		**SAMPLE ID/TYPE**	TP-1	
PROJECT NO.	2019-032		**SAMPLE DEPTH**	2.5'	
TECH/TEST DATE	ELW	3/8/2019	**DATE RECEIVED**	3/8/2019	

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	1148.4
Wt Dry Soil & Tare (gm)	(w2)	1116.9
Weight of Tare (gm)	(w3)	16.1
Weight of Water (gm)	(w4=w1-w2)	31.5
Weight of Dry Soil (gm)	(w5=w2-w3)	1100.8
Moisture Content (%)	(w4/w5)*100	3

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

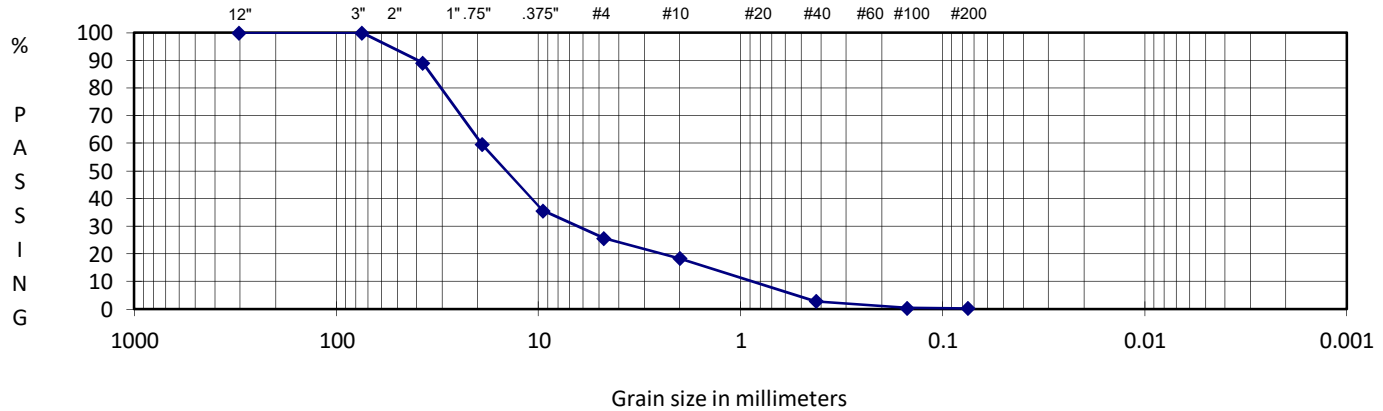
Weight Of Sample (gm)		1116.9
Tare Weight (gm)		16.1
(W6) Total Dry Weight (gm)		1100.8

% COBBLES	**0.0**
% C GRAVEL	**40.4**
% F GRAVEL	**34.0**
% C SAND	**7.3**
% M SAND	**15.6**
% F SAND	**2.5**
% FINES	**0.3**
% TOTAL	**100.0**

D10 (mm)	0.85
D30 (mm)	6.5
D60 (mm)	19
Cu	22.4
Cc	2.6

SIEVE ANALYSIS

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	16.1	0.00	0.00	100.00	cobbles
3.0"	16.1	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"					coarse gravel
1.5"	136.9	120.80	10.97	89.03	coarse gravel
1.0"					coarse gravel
0.75"	461.0	444.90	40.42	59.58	fine gravel
0.50"					fine gravel
0.375"	724.8	708.70	64.38	35.62	fine gravel
#4	834.9	818.80	74.38	25.62	coarse sand
#10	914.9	898.80	81.65	18.35	medium sand
#20					medium sand
#40	1086.1	1070.00	97.20	2.80	fine sand
#60					fine sand
#100	1112.9	1096.80	99.64	0.36	fine sand
#200	1114.1	1098.00	99.75	0.25	fines
PAN	1116.9	1100.80	100.00	0.00	silt/clay



DESCRIPTION	GRAVEL with some sand
USCS	GW

Prepared For:
Partners Architecture Design Group, Inc.

Reviewed By:
RW

RILEYGROUP

THE RILEY GROUP, INC.
17522 Bothell Way NE
Bothell, WA 98011

PHONE: (425) 415-0551
FAX: (425) 415-0311

GRAIN SIZE ANALYSIS
ASTM D421, D422, D1140, D2487, D6913

PROJECT TITLE	Dupont Starbucks Coffee		**SAMPLE ID/TYPE**	TP-1	
PROJECT NO.	2019-032		**SAMPLE DEPTH**	6'	
TECH/TEST DATE	ELW	3/8/2019	**DATE RECEIVED**	3/8/2019	

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	1339.1
Wt Dry Soil & Tare (gm)	(w2)	1303.1
Weight of Tare (gm)	(w3)	16.0
Weight of Water (gm)	(w4=w1-w2)	36.0
Weight of Dry Soil (gm)	(w5=w2-w3)	1287.1
Moisture Content (%)	(w4/w5)*100	3

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

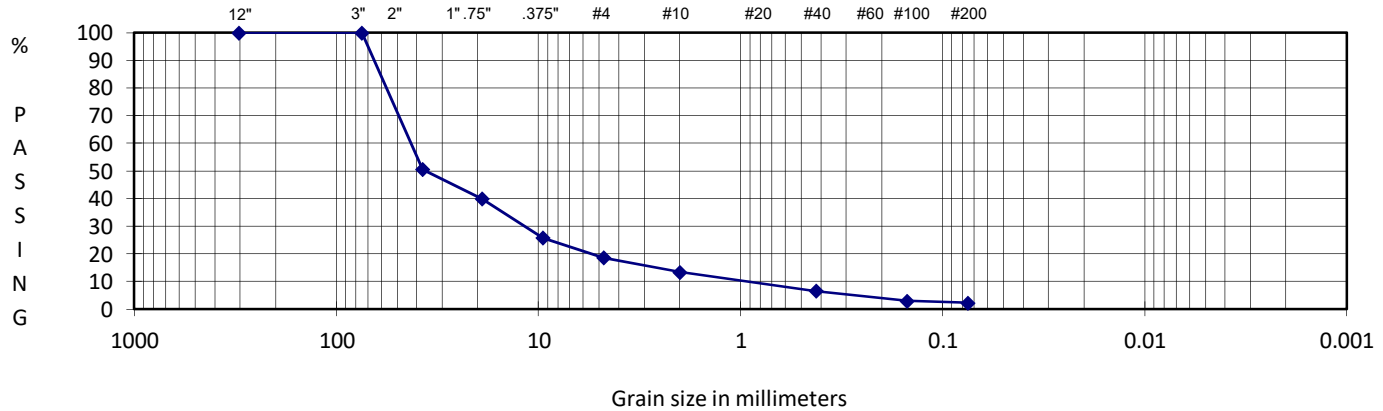
Weight Of Sample (gm)		1303.1
Tare Weight (gm)		16.0
(W6) Total Dry Weight (gm)		1287.1

% COBBLES	**0.0**
% C GRAVEL	**60.1**
% F GRAVEL	**21.3**
% C SAND	**5.2**
% M SAND	**6.9**
% F SAND	**4.3**
% FINES	**2.2**
% TOTAL	**100.0**

D10 (mm)	0.9
D30 (mm)	12
D60 (mm)	43
Cu	47.8
Cc	3.7

SIEVE ANALYSIS

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	16.0	0.00	0.00	100.00	cobbles
3.0"	16.0	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"					coarse gravel
1.5"	653.1	637.10	49.50	50.50	coarse gravel
1.0"					coarse gravel
0.75"	790.0	774.00	60.14	39.86	fine gravel
0.50"					fine gravel
0.375"	972.0	956.00	74.28	25.72	fine gravel
#4	1063.6	1047.60	81.39	18.61	coarse sand
#10	1130.5	1114.50	86.59	13.41	medium sand
#20					medium sand
#40	1219.6	1203.60	93.51	6.49	fine sand
#60					fine sand
#100	1264.8	1248.80	97.02	2.98	fine sand
#200	1274.7	1258.70	97.79	2.21	fines
PAN	1303.1	1287.10	100.00	0.00	silt/clay



DESCRIPTION	GRAVEL with some sand and trace silt
USCS	GP

Prepared For:
Partners Architecture Design Group, Inc.

Reviewed By:
RW

RILEYGROUP

THE RILEY GROUP, INC.
17522 Bothell Way NE
Bothell, WA 98011

PHONE: (425) 415-0551
FAX: (425) 415-0311

GRAIN SIZE ANALYSIS
ASTM D421, D422, D1140, D2487, D6913

PROJECT TITLE	Dupont Starbucks Coffee		**SAMPLE ID/TYPE**	TP-1	
PROJECT NO.	2019-032		**SAMPLE DEPTH**	7.5'	
TECH/TEST DATE	ELW	3/8/2019	**DATE RECEIVED**	3/8/2019	

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	1083.1
Wt Dry Soil & Tare (gm)	(w2)	1036.7
Weight of Tare (gm)	(w3)	16.0
Weight of Water (gm)	(w4=w1-w2)	46.4
Weight of Dry Soil (gm)	(w5=w2-w3)	1020.7
Moisture Content (%)	(w4/w5)*100	5

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

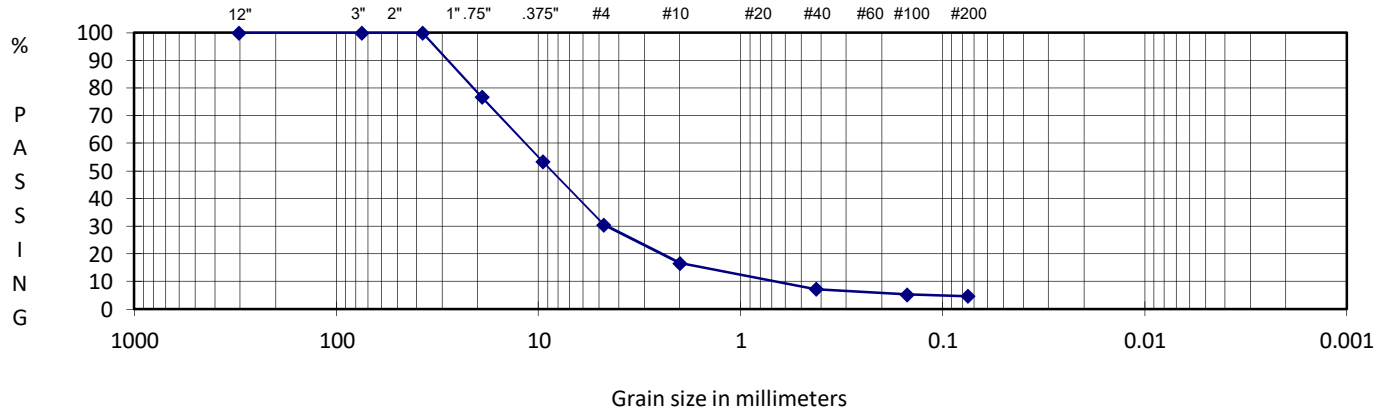
Weight Of Sample (gm)		1036.7
Tare Weight (gm)		16.0
(W6) Total Dry Weight (gm)		1020.7

% COBBLES	**0.0**
% C GRAVEL	**23.3**
% F GRAVEL	**46.3**
% C SAND	**13.8**
% M SAND	**9.4**
% F SAND	**2.6**
% FINES	**4.7**
% TOTAL	**100.0**

D10 (mm)	0.7
D30 (mm)	4.5
D60 (mm)	12
Cu	17.1
Cc	2.4

SIEVE ANALYSIS

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	16.0	0.00	0.00	100.00	cobbles
3.0"	16.0	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"					coarse gravel
1.5"	16.0	0.00	0.00	100.00	coarse gravel
1.0"					coarse gravel
0.75"	253.5	237.50	23.27	76.73	fine gravel
0.50"					fine gravel
0.375"	492.2	476.20	46.65	53.35	fine gravel
#4	726.0	710.00	69.56	30.44	coarse sand
#10	867.0	851.00	83.37	16.63	medium sand
#20					medium sand
#40	962.7	946.70	92.75	7.25	fine sand
#60					fine sand
#100	983.3	967.30	94.77	5.23	fine sand
#200	988.8	972.80	95.31	4.69	fines
PAN	1036.7	1020.70	100.00	0.00	silt/clay



DESCRIPTION	GRAVEL with some sand and trace silt
USCS	GW

Prepared For:
Partners Architecture Design Group, Inc.

Reviewed By:
RW

RILEYGROUP